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Patent, January 14, 1913

601 N o . 1050601 THE UNITED STATES OF AMERICA TO ALL TO WHOM THESE PRESENTS SHALL COME:

Whereas ALEXANDER GRAHAM BELL, of Washington, District of Columbia, ha S presented to the Commissioner of Patents a petition praying for the grant of Letters Patent for an alleged new and useful improvement In FLYING-MACHINES, a description of which invention is contained in the specification of which a copy is hereunto annexed and made a part hereof, and ha S complied with the various requirements of Law in such cases made and provided, and

Whereas upon due examination made the said Claimant is adjudged to be justly entitled to a patent under the Law.

Now therefore these Letters Patent are to grant unto the said

Alexander Graham Bell, his heirs or assigns for the term of Seventeen years from the fourteenth day of January, one thousand nine hundred and thirteen, the exclusive right to make, use and vend the said invention throughout the United States and the Territories Thereof.

In testimony whereof, I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington this fourteenth day of January, in the year of our Lord one thousand nine hundred and thirteen, and of the Independence of the United States of America the one hundred and thirty-seventh.

M. Billings Acting Commissioner of Patents

UNITED STATES PATENT OFFICE. ALEXANDER GRAHAM BELL, OF WASHINGTON, DISTRICT OF COLUMBIA. FLYING-MACHINE.

1,050,601. Specification of Letters Patent. **Patented Jan. 14, 1913.**

Application filed February 8, 1910. Serial No. 542,679.

To all whom it may concern:

Be it known that I, Alexander Graham Bell, of Washington, District of Columbia, have invented a new and useful Improvement 5 in Flying-Machines, which invention is fully set forth in the following specification.

This invention relates to flying machines, and more particularly to the means employed for maintaining or restoring the lateral 10 equilibrium of such machines.

It has heretofore been proposed to effect the lateral balance of flying machines by forming the supporting surfaces flexible at their lateral marginal portions, and by properly 15 flexing or warping these surfaces to preserve the balance of the machine or restore such balance when it has become disturbed.

By the present invention, the supporting 20 surfaces are preferably made rigid and non-flexible, so that they could not be readily warped, and a balancing device or balancing rudder is employed consisting of a vertical rudder lying approximately in the medial 25 vertical fore and aft plane of the machine when such machine is in a normal horizontal position. Such balancing rudder may be placed either above or below the supporting surface of the machine, though preferably 30 as a matter of convenience in manipulating the machine, it is placed above the same. The balancing rudder is mounted on an upright axis within the medial vertical plane of the machine, which axis is preferably located 35 approximately at the center of pressure of the air acting to support the machine. When the machine is on an even keel, that is, when the lateral equilibrium is undisturbed, the

balancing rudder or device 40 lies within the fore and aft medial plane, but when the balance of the machine is disturbed, the balancing rudder is turned about its axis by suitable means provided for this purpose, so as to incline the rudder to that 45 side of the axis toward the lower side of the machine. The effect of the resistance offered by the air as the machine is moving rapidly forward is to again restore the lateral balance of the machine, whereupon the 50 balancing rudder is returned to its normal position. If a rudder of this kind were placed to the rear of the center of pressure of the machine, the effect of employing the same would be to alter the direction of 55 movement of the machine, turning the same toward the same side of the machine as that to which the rudder is inclined as in the ordinary steering rudder. Likewise, if the rudder were placed in advance of the center of pressure of the machine, the effect would 60 be to alter the line of movement of the machine, turning the same to the opposite side from which the rudder is inclined. When, however, my balancing rudder is employed, and the axis of the same is fixed at or approximately 65 at the center of pressure of the machine, there is no tendency to alter the direction of movement of the machine, the effect being to effect and maintain the balance of the machine. 70

My balancing device is not limited in its application to any particular form of supporting surface or so-called aeroplane. It may be employed with monoplanes, biplanes, or other similar structures. It is likewise 75 applicable to power-driven machines or to soaring machines. Neither is the invention limited to any particular form or outline of the balancing rudder, and the surfaces of the rudder may be either flat plane surfaces, or 80 if desired may be slightly convex or concave.

The inventive idea is capable of receiving a variety of mechanical expressions, one of which, for the purpose of illustrating the invention, is shown in the accompanying 85 drawings, in which—

Figure 1 is a top plan view of a flying machine with my balancing rudder in its normal position, that is, the position which it occupies when the machine is evenly 90 balanced;

Fig. 2 is a front elevation of Fig. 1, with the elevating and depressing rudder omitted; Fig. 3 is a side elevation of Fig. 1; Figs. 4, 5 and 6 are details showing different forms of the balancing rudder; Fig. 7 is a 95 perspective view showing one form of means for controlling the inclination of the rudder; and Figs. 8 and 9 are diagrammatic outlines showing the manner in which the balancing rudder is inclined to restore the lateral equilibrium 100 of the machine when it has become disturbed.

Referring to the drawings, in which like reference numerals indicate like parts, 1 is a flying machine of any suitable construction, 105 here shown as a machine having two rigid supporting surfaces 2 and 3, and propelled by any suitable motor 4 driving the propeller 5. The rear steering rudder is indicated at 6, and the forward elevating 110 and depressing rudder at 7, these devices being manipulated by suitable connections 2 from a steering wheel 8, controlled by the aviator sitting on a seat 9, the whole machine being preferably mounted on a suitable chassis or framework 10 carried by wheels 11, 11.

5 The particular machine here described does not form any part of the present invention, and is merely shown and described for the purpose of facilitating the description 10 of my balancing apparatus, it being distinctly understood that said balancing rudder or device is in no way dependent on the particular or specific form of flying machine to which it is applied.

15 Referring to Figs. 1, 2, and 3, 12 is an upwardly projecting shaft turning in suitable bearings on the machine, and as here shown, extending above the upper supporting surface of the machine, and having rigidly 20 attached thereto a framework 13 covered with any light, tightly drawn material, as oil silk 14. As shown in Fig. 3, this balancing rudder or device is approximately rectangular, but it will be understood that 25 it may assume other forms, such for example, as those shown in Figs. 4, 5 and 6.

The vertical shaft 12, constituting the axis for the steering rudder or device, is preferably placed in or approximately in the center 30 of pressure of the air acting to support the

machine when the same is in flight, this being for the purpose of avoiding any tendency to change the direction of forward movement of the machine, which would 35 result if the axis of the balancing rudder or device was either in front of or behind the center of pressure. In the machine chosen for illustration, the center of pressure is approximately near the forward edge of the 40 machine as shown.

Any suitable means may be employed for turning the balancing rudder or device on its axis when it is desired to manipulate the same for restoring the lateral balance of the 45 machine. As shown in Figs. 1 to 6, such means consist of a fork 15 carried on an arm 16, rigidly secured to the shaft 12 and projecting forward in such shape that the fork 15 embraces the body of the aviator. When 50 the lateral balance of the machine is disturbed, the aviator naturally inclines his body toward the upper or higher side of the machine, thus acting to throw the fork, and with it the lever arm 16, toward such upper 55 side, thereby turning the balancing rudder or device to the opposite side, as clearly illustrated in Figs. 8 and 9, and as the machine is restored to its normal balance, the aviator's body returns to normal central 60 position, thus swinging the fork 15 to the center, and with it the balancing rudder or device 13, as clearly shown in Figs. 1 and 2. If desired, any other means for turning the balancing rudder or device upon its axis 65 may be employed. For example, the fork 15 may be mounted on a lever 17 (Fig. 7), pivoted at 18, and having a rearwardly projecting arm 19, with controlling wires or cables 20 and 21 extending from opposite sides thereof, and through suitable pulleys 70 22, 23, 24 and 25, to the framework of the balancing rudder, the wires or cables 20, 21, being crossed, as clearly shown in Fig. 7. The result of this construction is the same as that shown in other figures of the drawings, 75 viz., when the aviator shifts his body to the upper side of the machine, the balancing rudder or device is shifted toward the lower side thereof, and acts to restore the lateral balance of the machine. Other devices 80 may be employed for controlling the balancing rudder or device, but those shown are sufficient to illustrate the inventive idea involved.

It will be apparent to those skilled in the 85 art that various modifications and changes in form and proportion of parts may be employed without departing from the inventive idea involved. Thus, for example, the balancing rudder or device might be placed 90 below the supporting surface or surfaces, rather than above the same, though manifestly, while the balancing rudder or device in this position would be efficient for effecting the desired purpose, it would be an inconvenient 95 position, and preferably is placed above the machine, as shown.

What I claim is:—

1. In a flying machine, the combination of a supporting surface, and unitary means for 100 balancing said machine pivoted above said supporting surface in a plane normal thereto along the medial fore and aft line of said surface and at approximately the center of pressure of the machine. 105

2. In a flying machine, the combination of a supporting surface, and a unitary device for balancing said machine turning on an axis normal to said supporting surface at approximately the center of pressure of the 110 machine.

3. In a flying machine, the combination of a supporting surface, and a unitary balancing device turning on an axis normal to the medial fore and aft line of said supporting 115 surface at approximately the center of pressure of the machine, and means for turning said device about said axis.

4. In a flying machine, the combination of a supporting surface, and unitary means for 120 balancing said machine turning on an axis normal to said supporting surface at approximately the center of pressure of the machine, and means for turning said balancing means about said axis. 125

5. In a flying machine, the combination of propelling means, a supporting surface, a steering rudder, an elevating and depressing rudder, and a unitary balancing device

turning on an axis normal to said supporting 130 3 surface at approximately the center of pressure of the machine.

6. In a flying machine, the combination of a supporting surface, with a unitary balancing 5 rudder or device lying in a plane passing through the medial fore and aft line of said surface at approximately the center of pressure of the machine, which plane is vertical when the machine is balanced laterally, 10 and means operative by the aviator for turning said rudder or device on an axis within said plane.

7. In a flying machine, the combination of a propelling means, a supporting surface, a 15 steering rudder and an elevating and depressing rudder, one of said rudders being at the front and the other at the rear, with a unitary balancing rudder or device located between said first-named rudders, in a 20 plane normal to the medial fore and aft line of said supporting surface and at approximately the center of pressure of the machine.

8. In a flying machine, the combination of a propelling means, a supporting surface, a unitary balancing rudder or device above 25 said surface in a plane that is vertical when said surface is in a state of lateral balance and at approximately the center of pressure of the machine, and means under control of the aviator for turning said rudder or device 30 about its axis to restore or maintain the lateral balance of the machine.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ALEXANDER GRAHAM BELL.

Witnesses:

W. B. Kerkam,

S. T. Cameron.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."